Survey of Research on Learning Styles

A number of studies conducted during the last decade have found that students’ achievement increases when teaching methods match their learning styles—biological and developmental characteristics that affect how they learn.

Research on learning styles has been conducted at more than 60 universities over the past decade. These investigations have yielded useful findings about the effects of environmental, emotional, sociological, physiological, and cognitive preferences on the achievement of students. Learning style is a biologically and developmentally imposed set of personal characteristics that make the same teaching method effective for some and ineffective for others.

Every person has a learning style—it’s as individual as a signature. Knowing students’ learning styles, we can organize classrooms to respond to their individual needs for quiet or sound, bright or soft illumination, warm or cool room temperatures, seating arrangements, mobility, or grouping preferences. We can recognize the patterns in which people tend to concentrate best—alone, with others, with certain types of teachers, or in a combination thereof. We become aware of the senses through which people remember difficult information most easily—by hearing, speaking, seeing, manipulating, writing or notetaking, experiencing, or, again, a combination of these.

Learning style also encompasses motivation, on-task persistence versus the need for multiple assignments simultaneously, the kind and amount of structure required, and conformity versus nonconformity. When a National Association of Secondary School Principals (NASSP) Task Force (1983) examined all the characteristics that influence student achievement, intake preferences (individual needs for eating and/or drinking while concentrating) achieved the highest reliability. Chronobiology is also part of style: some people are “morning people”; some are “night owls.”

There are only three comprehensive models of learning style (Hill et al. 1971, Keefe et al. 1986, Dunn et al. 1975, 1979, 1981, 1985); others address only one to four elements, usually on a bipolar continuum. Although various scholars define the concept differently, only a few learning style identification instruments are reliable and valid (Curry 1987).

Correlational Studies

To investigate connections between individual preferences and other influences on learning, researchers have conducted correlational studies to establish the relationships between learning style and birth order, cognitive development, maturation, hemisphericity, field dependence/independence, global/analytic processing, temperament, and self-concept. Their comparisons examined learners at all levels from primary school through adolescence. They differentiated among gifted, musically and artistically talented, average, underachieving, at-risk, nontraditional, reading-disabled, special education, dropout, and adolescent psychiatric populations. Researchers further tested consistency of style over subject matter and time. In addition, the researchers determined the responsiveness of basal readers to style differences, and they also examined the extent to which teacher training programs complemented their student candidates.

Correlational studies also explored the similarities and differences between and among diverse groups. Thus, researchers developed profiles of the styles of a wide range of learners, including students at various levels of achievement in diverse age groups; gifted, learning disabled, and mentally retarded students; supervisors and their supervisees; teachers and their students; Southeast Asian and American Caucasian college registrants; and numerous other groups. In addition, comparisons were made of the learning styles of Bahamians and Jamaicans; Afro-Americans and Caucasians; and Afro-, Chinese, Greek, and Mexican Americans (Annotated Bibliography 1988; Learning Styles Network Newsletter 1980-1988).

Correlations Between Learning Style and Hemisphericity

As new findings about left/right brain functions appeared, researchers investigated the connections between learning style and hemisphericity. The terms left/right, analytic/global, and inductive/deductive have been used interchangeably in the literature; descriptions of these pairs of variables parallel each other. Lefts/analytics/in-
ductives appear to learn successively, in small steps leading to understanding; rights/globals/deductives more easily learn by obtaining meaning from a broad concept and then focusing on details.

Studies that examined the similarities and differences between hemispheric style and other elements of learning style revealed that, when concentrating on difficult academic material:

1. High school students who were less motivated than their classmates and who preferred working with distracters (music, low illumination, informal or casual seating, peers rather than alone or with the teacher, tactile rather than auditory or visual instructional resources) scored right-hemisphere significantly more often than left-hemisphere. Also, students who scored high on persistence invariably scored high as left processors (Dunn et al. 1982). (The latter data may have implications for time-on-task research.)

2. Left-hemisphere youngsters in grades 5-12 preferred a conventional formal classroom seating design, more structure, less intake, and visual rather than tactile or kinesthetic resources during learning significantly more often than their right-preferred classmates (Cody 1983).

3. Right-hemisphere 5th through 12th graders disliked structure and were not adult motivated but were strongly peer motivated. Gifted and highly gifted students were significantly more often right or integrated than left processors (Cody 1983).

4. Right-hemisphere community college adult math underachievers preferred learning with sound and intake. They wanted tactile and kinesthetic instructional resources and mobility significantly more often than their left-hemisphere counterparts, who preferred bright light and a formal design. [When the predominantly right-hemisphere students were taught alternately with both global and analytic lessons, they achieved statistically higher test scores through the global, rather than through the analytic, resources (Bruno 1988).]

Thus, correlational studies revealed sets of traits among students within the same age or grade and among those with similar talents, achievement, and interests. Even when culturally diverse groups were examined, there were as many within-group as between-group differences. Within each family, the parents, their offspring, and the siblings tend to be more different from than similar to each other.

**Experimental Research**

These correlational findings prompted

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### Table: Experimental Research Concerned with Learning Styles and Instructional Environments

<table>
<thead>
<tr>
<th>Researcher/Date</th>
<th>Sample</th>
<th>Subject Examined</th>
<th>Element Examined</th>
<th>Significant Effects</th>
<th>Achievement</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DeGregoris 1986</td>
<td>6th, 7th, 8th graders</td>
<td>Reading comprehension</td>
<td>Kinds of sound needed by sound preferences</td>
<td>+ With moderate talking</td>
<td>Not tested</td>
<td></td>
</tr>
<tr>
<td>Dellavalle 1984</td>
<td>7th graders</td>
<td>Word recognition memory</td>
<td>Mobility/passivity needs</td>
<td>+</td>
<td>Not tested</td>
<td></td>
</tr>
<tr>
<td>Hodges 1985</td>
<td>7th, 8th graders</td>
<td>Mathematics</td>
<td>Formal/Informal design preferences</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Krimsky 1982</td>
<td>4th graders</td>
<td>Reading speed and accuracy</td>
<td>Bright/low lighting preferences</td>
<td>+</td>
<td>Not tested</td>
<td></td>
</tr>
<tr>
<td>MacMurren 1985</td>
<td>6th graders</td>
<td>Reading speed and accuracy</td>
<td>Need for intake while learning</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Miller 1985</td>
<td>2nd graders</td>
<td>Reading</td>
<td>Mobility/passivity needs</td>
<td>+</td>
<td>Not tested</td>
<td></td>
</tr>
<tr>
<td>Murrain 1983</td>
<td>7th graders</td>
<td>Word recognition/memory</td>
<td>Temperature preference</td>
<td>0</td>
<td>Not tested</td>
<td></td>
</tr>
<tr>
<td>Pizzo 1983</td>
<td>6th graders</td>
<td>Reading</td>
<td>Acoustical preference</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Shea 1983</td>
<td>9th graders</td>
<td>Reading</td>
<td>Formal/Informal design preferences</td>
<td>+</td>
<td>Not tested</td>
<td></td>
</tr>
<tr>
<td>Stiles 1985</td>
<td>5th graders</td>
<td>Mathematics testing</td>
<td>Formal/Informal design preferences</td>
<td>0</td>
<td>Not tested</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Price (1980) reported that the older students became, the less they appeared able to adapt to a conventional setting. Thus, design may be far more crucial to secondary students' ability to concentrate than to 4th graders, who may be better able to adjust to this element. Dunn and Griggs (1988) described the importance of design to high schoolers throughout the United States. (+) = significant positive findings at p<.01 or greater; (0) = no differences or slight trend.*

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**Fig. 1. Experimental Research Concerned with Learning Styles and Instructional Environments**
researchers to conduct experimental studies to determine the effects of individual learning style on achievement, attitudes, and/or behavior.

On Instructional Environments
The extent to which classrooms appear either to stimulate or to inhibit learning for students with selected learning style characteristics has been documented in terms of individuals' needs for quiet versus sound, bright or soft lighting, warm or cool temperatures, and formal versus informal seating designs (Dunn 1987, Dunn et al. 1985; see fig. 1). These four elements affect from 10 to 40 percent of students, dependent upon age, gender, hemisphericity, and achievement. For example, the need for sound remains fairly consistent during the elementary school years but increases as adolescence begins and, as that stage passes, appears to return to its previously normal level.

The need for sound remains fairly consistent during the elementary school years but increases as adolescence begins and, as that stage passes, appears to return to its previously normal level.

On Perceptual Preferences
In addition to the instructional environment, sensory preferences influence the ways in which students learn. Eight studies within the past decade reveal that when youngsters were taught with instructional resources that both matched and mismatched their preferred modalities, they achieved statistically higher test scores in modality-matched, rather than mismatched, treatments (Dunn 1988; see fig. 2). In addition, when children were taught with multisensory resources, but initially through their most preferred modality and then were reinforced through their secondary or tertiary modality, their scores increased even more.

Perceptual preferences affect more than 70 percent of school-age youngsters. High school teachers who have translated their curriculum into electroboards, Flip chutes, multipart task cards, and Pick-A-Holes reported increased achievement and interest when such manipulatives were available for highly tactual students (Dunn and Griggs 1988)

Data from studies conducted before the late '70s concerned with perceptual

<table>
<thead>
<tr>
<th>Researcher/Date</th>
<th>Sample</th>
<th>Subject Examined</th>
<th>Perceptual Preference Examined</th>
<th>Significant Effects</th>
<th>Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbo 1980</td>
<td>Kindergartners</td>
<td>Vocabulary</td>
<td>Auditory, visual, &quot;other&quot; (tactile)</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Jansonbeck 1984</td>
<td>4th grade underscience</td>
<td>Mathematics</td>
<td>Auditory, visual, tactile</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Kroon 1985</td>
<td>9th, 10th graders</td>
<td>Industrial Arts</td>
<td>Auditory, visual, tactile, sequenced</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Martini 1986</td>
<td>7th graders</td>
<td>Science</td>
<td>Auditory, visual, tactile</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Urbschat 1977</td>
<td>1st graders</td>
<td>CVC Trigram Recall</td>
<td>Auditory, visual</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Weinberg 1983</td>
<td>3rd graders</td>
<td>Mathematics</td>
<td>Auditory, visual, tactile</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Wheeler 1980</td>
<td>Learning disabled 2nd graders</td>
<td>Reading</td>
<td>Auditory, visual, tactile, sequenced</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Wheeler 1983</td>
<td>Learning disabled 2nd graders</td>
<td>Reading</td>
<td>Auditory, visual, tactile</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

(+
= significant positive findings.

Fig. 2. Experimental Research Concerned with Perceptual Learning Styles
strengths often were conflicting because of inappropriate statistical designs, poor analyses, misinterpretations of the findings, and/or faulty conclusions. Those investigators examined group mean gain scores—which are inappropriate for determining whether individuals achieve better, the same, or less well in comparison with their own baseline data when they are taught through their preferences. In addition, the words tactile and kinesthetic often were used interchangeably. Tactile suggests learning with hands through manipulation of resources, but writing is not tactile enough for children below 4th grade. Kinesthetic implies whole-body involvement, such as taking a trip, dramatizing, interviewing, or pantomiming. However, even when older studies identified tactile strengths, their treatments did not introduce the new material that way. Finally, studies that employed many diverse instruments, populations, methods, and statistical designs and that confused the terminology could not yield solid data.

### On Sociological Preferences

The influence of students' social preferences also affects their achievement in school. Figure 3 shows that, in four of five studies, when students' sociological preferences were identified and the youngsters then were taught in multiple treatments both responsive and unresponsive to their diagnosed learning styles, they achieved significantly higher test scores in matched conditions and significantly lower test scores when mismatched.

How do sociological preferences interface with cooperative learning? The higher the grade level, the less teacher-motivated students become (Price 1980). Thus, there are more peer-oriented youngsters able to work in well-organized small groups than there are students willing to learn directly from their teachers. Nevertheless, in every class we have ever tested, there are students who prefer to learn by themselves with appropriate resources, others who prefer to learn with peers, and some who wish to work directly with their teachers (Price 1980).

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**Learning Styles and Student Diversity**

Sue Loper

As a young teacher, I inherited a junior high classroom from a teacher who left in midyear. The students were totally out of control. I made it through the year, but I was not pleased with my performance.

I unloaded my feelings of frustration on Margaret Payne, who taught next door. She had a reputation for being able to teach even the worst students. In fact, she often accepted problem students during the year when other teachers could no longer tolerate them. Students liked learning in her class; she made them feel special and successful. Each time they succeeded, they wanted to try again.

Ms. Payne listened to my complaints, made sympathetic sounds, and proceeded to offer practical advice: that I teach my students the way they learned best; in other words, that I determine my students' preferred learning styles and provide activities to match them. She suggested that I use several methods of presenting material and include a variety of activities—individual and group projects—ranging from the replicative to the highly creative. Ms. Payne understood that different students learn in different ways, while teachers often teach as they have been taught (Dunn and Dunn 1978).

This was certainly true in my own case. Because I learn well auditorily, I tended to teach in a lecture format. Unfortunately, this tendency shortchanged the visual, kinesthetic, and tactile learners in my classroom. Because I am a self-directed learner, I assigned mostly individual projects to be completed by a certain date. These assignments were difficult for students who learned best in a group or who needed encouragement, assistance, or prodding to finish a project. Furthermore, I didn't like gum chewing, foot tapping, or other extraneous movements or noise. Yet I had students who needed those activities in order to learn (Dunn and Dunn 1978).

If a teacher teaches and evaluates in only one cognitive mode, he or she is inadequately serving only those students who prefer to learn in that mode. To give every learner the opportunity to succeed, teachers can expand their repertoires to include a variety of cognitive modes. Teachers should also become aware of their own learning style preferences and of how those preferences affect their teaching methods. Yet another goal is to help students move from one preferred learning mode to a base of mixed preferences, so they can benefit from various instructional modes.

If we make these changes, we will improve our chances of success at educating a diverse student population.

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**Reference**


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From practical experience, educators generally consider the junior high school years a period of strong peer influence. By the beginning of grade 9, however, educators should expect movement away from that preference; Price (1980) found that students in grades 9-12 experience a greater need to learn and study alone than during any other interval. The gifted also prefer to learn alone unless the material to be mastered is difficult for them; when that happens, they prefer to learn with other gifted children (see fig. 3). Thus, except among the gifted, many students in grades 3-8 will learn better in small, well-organized groups than either alone or with the teacher. After grade 8, however, more will learn better alone.

In a small group structure, children who are frequently chastised for not sitting quietly can move about and...
Relieve the discomfort they experience because of mobility needs or hard chairs. This structure also permits youngsters to read together, discuss items, reason out answers, and use multisensory interactions. The various contributors may enjoy different processing styles; thus, they can help each other, especially when the teacher's dominant hemispheric style is incongruent with theirs. Despite the advantages to group work, students who feel constrained by the slower group pacing or who enjoy the challenge of solving problems by themselves do not learn most easily through small-group instructional strategies, nor do they enjoy the experience.

**Research on Time-of-Day Preferences**

It is common knowledge that morning people and night owls function better at their respective times of day. The research supports our easy acceptance of these preferences. For example, two junior high school principals revealed that the math underachievers in both their schools preferred learning in the afternoon but had been scheduled into morning math classes. When those youngsters were rescheduled into afternoon classes, they evidenced higher motivation, better discipline, and an increase in achievement. Three years later, a New York high school reported that time preference was a crucial factor in the reversal of initial and chronic truancy patterns among

<table>
<thead>
<tr>
<th>Researcher/Date</th>
<th>Sample</th>
<th>Subject Examined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholakis 1986</td>
<td>106 underachieving, inner-city, parochial school 7th and 8th graders</td>
<td>Vocabulary development was provided through three strategies—by the teacher, alone by themselves, and in a peer group treatment.</td>
</tr>
<tr>
<td><strong>Findings:</strong> Those who preferred learning alone, scored significantly higher (0.01) than those who preferred learning either with peers or the teacher. However, all students attained significantly higher achievement (0.001) and attitude (0.01) scores when learning with an authority figure.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DeBello 1985</td>
<td>236 suburban 8th graders</td>
<td>Students wrote social studies compositions and then experienced revision strategies that were congruent and incongruent with their sociological preferences.</td>
</tr>
<tr>
<td><strong>Findings:</strong> Peer learners scored significantly higher when matched with the peer-conferencing technique (0.01). Authority-oriented learners, when revising through the teacher-conference, achieved statistically higher (0.01) than when revising either through peer conferencing or self-review. And those who preferred to learn alone scored significantly higher (0.01) when matched, rather than mismatched, with self-review. No learning style group achieved better than any other, but a significant interaction occurred between individual sociological style and the matched method of revision (0.001). In addition, the attitudes of students who preferred to learn alone or with an adult were significantly more positive (0.01) when they were assigned to approaches that matched their styles.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glianiti 1988</td>
<td>104 suburban, parochial and public school 6th, 7th and 8th graders</td>
<td>Social studies taught through both a mini-Contract Activity Package (CAP) and a small-group strategy, Team Learning.</td>
</tr>
<tr>
<td><strong>Findings:</strong> Peer-oriented students achieved significantly higher test and attitudes scores when learning through Team Learning than through the mini-Cap (0.001). Learning-alone preferences attained significantly higher test and attitude scores (0.01) through the mini-Cap than with their peers. Non-preferenced students achieved better through the mini-Cap than through the Team Learning and liked working alone better than in groups. A significant interaction occurred between learning alone and peer-preferenced learning and the method of learning (mini-Cap and Team Learning).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miles 1987</td>
<td>40 inner-city 5th and 6th graders</td>
<td>Twenty-two who preferred to learn alone and 18 who preferred to learn with peers were assigned randomly to two instructional groups that taught career awareness and career decision-making concepts in conditions both congruent and incongruent with their preferences.</td>
</tr>
<tr>
<td><strong>Findings:</strong> The matching of sociological preference with complementary grouping patterns increased achievement significantly on career awareness (0.01) and career decision making (0.01). In addition, students' attitude scores were statistically higher when they were taught career awareness (0.01) and career decision-making concepts (0.05) in patterns accommodating their sociological preferences. With the exception of career awareness achievement, neither sociologically preferenced group achieved better than the other but learning-alone preferences scored higher (0.05) than peer-preferenced individuals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perrin 1984</td>
<td>104 gifted and nongifted, suburban 1st and 2nd graders</td>
<td>Problem solving and word recognition through both individual- and peer-group strategies. Learning with the teacher was eliminated as a strategy when not a single gifted child preferred to learn that way.</td>
</tr>
<tr>
<td><strong>Findings:</strong> Analysis of the mean gain scores revealed that achievement was significantly higher (0.05) whenever students were taught through approaches that matched their diagnosed sociological preferences. Although the gifted tended to prefer to learn alone in their heterogeneously grouped cases, a small group of seven gifted, who previously had known each other from participation in a special, part-time program for the gifted, actually performed best when learning in isolation with other gifted children.</td>
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</tbody>
</table>

Fig. 3. Experimental Research Concerned with Sociological Preferences
Most students are not morning-alert.... Only about one-third of more than a million students we have tested prefer learning in the early morning, and the majority prefer late morning or afternoon.

Mobility Needs
One element of learning style is the need for physical activity, and a review of this research reveals how this need can be confused with other, more alarming diagnoses. For example, Fadley and Hosier (1979) noted that children often were referred to psychologists because of their consistent hyperactivity; their teachers complained that such youngsters were unable to sit quietly and pay attention during lessons. Those psychologists reported that most students sent to them were not at all clinically hyperactive; instead, they were normal children in need of movement. In addition, the less interested they were in the lesson, the more mobility the children required.

During the same period, Restak (1979) substantiated that "over 95 percent of hyperactives are males" (p. 230) and that the very same characteristic, when observed in girls, correlated with academic achievement. He deplored that boys were required to be passive in school and were rejected for aggressive behaviors there, but were encouraged societally to engage in typical male aggressions in the world at large; this paradox could lead to role conflict. Restak added that conventional classroom environments did not provide male students with sufficient outlets for their normal needs. He warned that schools actually caused conflict with societal expectations that boys not be timid, passive, or conforming.

Other researchers corroborated Restak's admonitions and chastised educators for believing that physical activity prevented, rather than enhanced, learning. Indeed, when previously restless youngsters were reassigned to classes that did not require passivity,
their behaviors were rarely noticed. Eventually, teachers began to report that although certain students thrived in activity-oriented environments that permitted mobility, others remained almost exclusively in the same area despite frequent attempts to coax them to move (Dunn et al. 1986). That led to Fitt’s (1975) conclusions that no amount of persuasion increased certain children’s interest in movement, whereas others found it impossible to remain seated passively for extended periods. “These are cases of a child’s style….governing his interaction with and within the environment” (p. 94).

DellaValle’s (1984) research documented that almost half the 7th graders in a large urban racially mixed but predominantly black junior high school could not sit still for any length of time. Twenty-five percent could but only when interested in the lesson, and the remaining 25 percent preferred passivity. When preference and environment were matched, students’ performance yielded significantly higher test scores than when they were mismatched. Figure 4 reports the post hoc analysis used to determine exactly where the interaction occurred. This analysis was conducted after the initial repeated measures design indicated a significant interaction at the .001 level.

**Everyone Has One**

Every person has a learning style—all have at least some preferences—the result of many influences. Certain learning style characteristics are biological, whereas others are developed through experience (Restak 1979, Thies 1979). Individual responses to sound, light, temperature, design, perception, intake, chronobiological highs and lows, mobility needs, and persistence appear to be biological; whereas sociological preferences, motivation, responsibility (conformity), and need for structure are thought to be developmental. The significant differences among diverse cultures tend to support this theory (Learning Styles Network Newsletter 1980-1988). Despite cultural influences, however, within each culture, socioeconomic strata, and classroom there are as many within-group differences as between-group differences. Indeed, each family includes parents and offspring with styles that differ.

Those who suggest that children should learn to adapt to their teachers’ styles disregard the biological nature of style. They also disregard Cafferty’s (1980) findings that the closer the match between each student’s and the teachers’ styles, the higher the grade point average; and the reverse. In addition, Kagan (1966) reported that his “success” with training impulsive students to become more reflective was evidenced only when adults were present. In addition, although Kagan’s subjects learned to respond more reflectively, their accuracy on tasks was decreased. Thus, educators can see that learning styles are not lightly held; they demonstrate remarkable resistance to change.

Identifying learning styles as a basis for providing responsive instruction has never been more important than now, as educators meet the needs of a diverse student population. To identify their students’ learning styles (Beaty 1986, Dunn et al. 1977, Marcus 1977), teachers must use a reliable and valid learning style preference instrument (Curry 1987). When permitted to learn difficult academic information or skills through their preferred methods, children tend to achieve statistically higher test and attitude scores than when instruction is dissonant with their preferences.

No learning style is either better or worse than another. Since each style has similar intelligence ranges, a student cannot be labeled or stigmatized by having any type of style. Most children can master the same content; how they master it is determined by their individual styles.

1. When we use the terms significant and significantly, we mean in a statistical sense.

**References**

Annotated Bibliography (1988) New York Center for the Study of Learning and Teaching Styles, St. John’s University


Sixth Annual Mid-Summer Institute for Instructional Excellence

Elements of Effective Instruction July 17-20, 1989
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